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EFFECTS OF GIBBERELLIC ACID ON THE GROWTH OF PONDEROSA PINE TREES

During the growing seasons of 1957 and 1958, tests were made of gibberellic acid on the growth of ponderosa pine trees. Two general tests were conducted: One on first-year seedlings and the other on shoot growth of saplings. The plan also called for observing the effects of gibberellic acid on flower production on the sapling trees, but the present report does not include results of this phase of the study.

METHODS

Three concentrations of gibberellic acid were used in each phase of the study. They were 1,000 p.p.m., 100 p.p.m., and 10 p.p.m. These, together with control, gave four treatments. First-year seedlings were sprayed with these solutions in June 1957, when the seedlings were about 6 weeks old. About 25 seedlings were used in each plot receiving a given treatment and the 4 treatments were replicated to give 8 plots in all. The seedlings were of such uniform size that no height measurements were required at the time of spraying.

For the sapling phase of the study, 5 replications of 4 trees each were selected and the trees to receive a particular treatment were randomly chosen from among each group of 4. Shoots were sprayed on June 13, 1957, and again on June 24, 1957. At the time of the initial

spraying, 1957 shoot growth had already started so the 8 to 12 shoots treated on each tree were measured. Final shoot length was then measured at the end of the 1957 growing season.

On June 4, 1958, the new growth on these same shoots was again treated with the gibberellic spray. A second application was not applied as had been done in 1957.

Final 1958 shoot growth was measured in the fall of 1958.

RESULTS AND DISCUSSION

After careful observations throughout the 1957 growing season, it was concluded that the gibberellic acid treatment had no visible effect on the height of first-year seedlings. The groups of seedlings, growing side by side, continued to appear the same height, color, and vigor, so it was concluded that no measurements would be needed to evaluate the results.

Sapling shoots, however, could not be so readily evaluated by observation alone, so an analysis of the shoot lengths was made for the 1957 growth and for the sum of the 1957 and 1958 growth. Table 1 shows the 1957 shoot length in inches for the June and the final fall measurements.

An analysis of covariance was used to test the effect of treatments on final growth after adjusting for initial shoot length. Table 2 shows the test in which the adjusted mean square for treatments is not significant.

Table 1.--Average shoot length of ponderosa pine saplings by treatment and replications for June (x) and final (y) 1957 growth.

Replications	Treatments							
	Control		1,000 p.p.m.		100 p.p.m.		10 p.p.m.	
	x	y	x	y	x	y	x	y
	-Inches-							
I	4.5	5.4	6.0	7.5	3.2	3.7	4.6	5.5
II	5.5	6.6	5.0	6.8	5.0	6.1	3.4	4.1
III	6.2	7.7	5.2	6.2	3.7	4.7	5.2	6.4
IV	4.9	5.9	7.1	9.0	6.9	8.3	7.6	9.5
V	3.5	4.0	3.3	4.5	3.8	4.4	3.9	4.5

Table 2.--An analysis of covariance testing adjusted mean square of treatments for the 1957 shoot growth.

Source of variation	DF	s.s.(y)	s.p.(xy)	s.s.(x)	Residuals	DF	Mean squares
Replications	4	30.9730	24.2650	19.0600			
Treatments	3	4.7680	2.7160	1.6015	0.4739	3	0.1580 1/
Error	12	19.3870	15.3090	12.4760	0.6917	11	0.0547
Total	19	55.1280	42.2900	33.1375			
Treatment plus error	15	24.1550	18.0250	14.0775	1.0756	14	

1/ F = 2.89 - not significant

Table 3 shows the sum of the 1957 and 1958 shoot growth as well as the initial June 1957 shoot length. These data were analysed in a manner similar to those for 1957 and the results appear in table 4. Once again, the adjusted mean square for treatments was not significant, although it approached closely to the 5 percent level of significance. One can only say that there is an indication that the treatments had some effect on shoot growth but that it was not pronounced enough to be considered real. It would appear that the most concentrated dosage was superior, with 100 p.p.m. being next best and 10 p.p.m. being least effective. These observations are not conclusive and are not large enough to be of practical value even if they could be shown as real effects.

Judging from the cost of the acid and the difficulty of application, it is very doubtful if gibberellic acid has any commercial value in stimulating pine tree growth. Its effect on flowering has not been evaluated as yet. These saplings will be observed during the next 2 years to see if flowers are produced. Ordinarily, trees this size do not produce flowers.

Table 3.--Average shoot length of ponderosa pine saplings by treatments and replications for June 1957 (x) and full 1957 and 1958 growth (y).

Replications	Treatments							
	Control		1,000 p.p.m.		100 p.p.m.		10 p.p.m.	
	x	y	x	y	x	y	x	y
	-Inches-							
I	4.5	9.7	6.0	13.0	3.2	7.1	4.6	9.2
II	5.5	10.7	5.0	12.3	5.0	11.1	3.4	7.8
III	6.2	12.7	5.2	10.4	3.7	11.2	5.2	11.3
IV	4.9	9.9	7.1	18.0	6.9	16.0	7.6	16.4
V	3.5	6.6	3.3	9.3	3.8	8.4	3.9	8.1

Table 4.--An analysis of covariance testing adjusted mean square of treatments for the sum of the 1957 and 1958 shoot growth.

Source of variation	DF	s.s.(y)	s.p.(xy)	s.s.(x)	Residuals	DF	Mean squares
Replications	4	108.0230	45.2000	19.0600			
Treatments	3	19.8560	3.6400	1.6015	11.9140	3	3.971
Error	12	53.4290	22.3300	12.4760	13.4620	11	1.224
Total	19	181.3080	71.1700	33.1375			
Treatment plus error	15	73.2850	25.9700	14.0775	25.3760	14	

F for treatments = 3.24
Required at 5 percent level = 3.59

Sketch of Boise Basin Experimental Forest Headquarters with location, in red, of ponderosa pine saplings sprayed with gibberellic acid